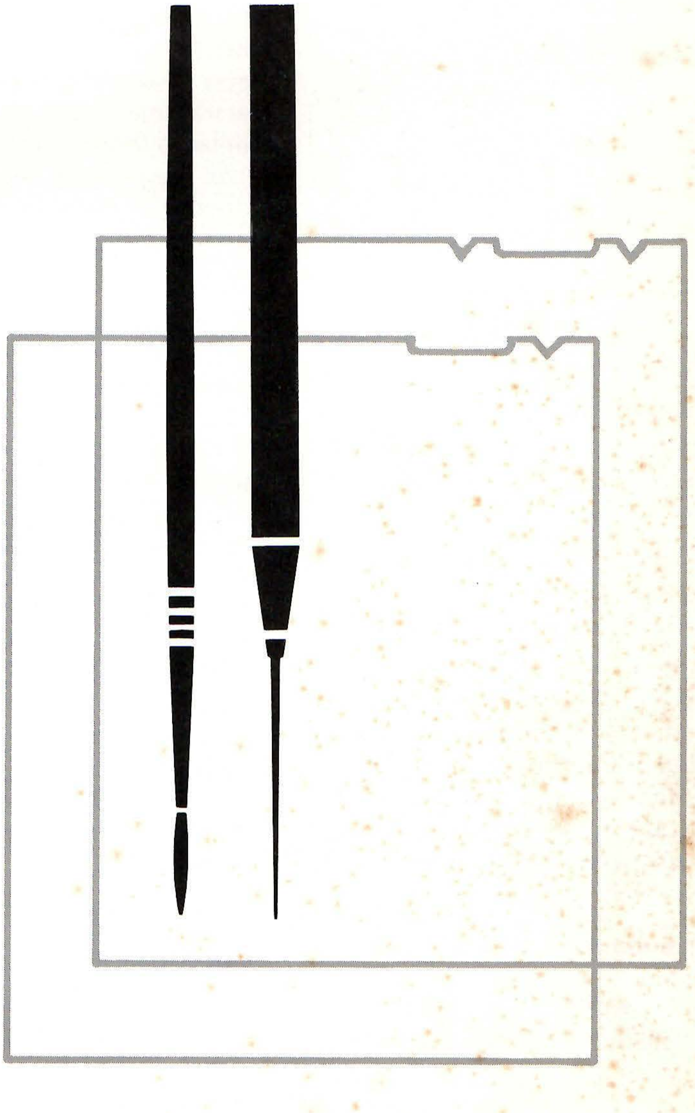
E-68

RETOUCHING *EKTACHROME* TRANSPARENCIES

(PROCESS E-6)



RETOUCHING *EKTACHROME* TRANSPARENCIES, PROCESS E-6

KODAK EKTACHROME Films for Process E-6 are manufactured with a hardened gelatin emulsion for high-temperature processing, and have bleaching and retouching characteristics that are different from those of other Kodak color transparency films. Because of the hardened emulsion, the selective bleaches, the total bleach, and the dye application may work more slowly. Increased retouching productivity can be achieved by carefully following the instructions regarding the use of Process E-6 bleaches, KODAK E-6 Transparency Retouching Dyes, and KODAK E-6 Retouching Dye Buffer. It is essential to make tests on discarded material in order to develop an effective technique before attempting to make any corrections on a valuable transparency.

PROCESS E-6 DYES AND BUFFER

KODAK E-6 Transparency Retouching Dyes consist of three 118 mL (4-fluid-ounce) bottles of:

- cyan dye concentrate
- magenta dye concentrate
- yellow dye concentrate

KODAK E-6 Retouching Dye Buffer concentrate is supplied in 118 mL (4-fluidounce) bottles. Diluted in the proportion of 1 part of buffer concentrate to 10 parts of water, it is used to dilute KODAK E-6 Transparency Retouching Dyes to working strength and to redissolve partially dried dyes in the palette.

Concentrated solutions of dyes and buffer are stable for at least one year if kept in *stoppered* glass bottles. The formation of a light yellow color in the concentrated buffer solution does not impair its action.

These dyes are recommended for use in correcting colors on all KODAK EKTACHROME Professional Films in sheets for Process E-6 (both original and duplicate transparencies) that are intended for photomechanical reproduction or duplicating onto film such as KODAK EKTACHROME Duplicating Film 6121 (Process E-6). The dyes have been designed so that their spectral transmission characteristics are similar to those of the image dyes, when applied as recommended. Other dyes may *not* give satisfactory reproduction results, even though a visual match is achieved.

Dye Application — Dyes can be added to either side of a transparency. However, dye application is usually faster on the base side because the dye penetrates the gel backing easier and dries faster. Also, for optimum stability of image dyes, application of KODAK E-6 Transparency Retouching Dyes should be limited to the base side. For uniformity of dye application on the base side, premoisten the area to be retouched, using a tuft of cotton dampened with a solution of one drop of KODAK PHOTO-FLO 200 Solution in 30 mL (1 fluidounce) of cool water.

In some cases, dye must be added to the emulsion side to avoid the effects of parallax, to come up to a sharp edge, or to produce a higher density in areas where dye saturation on the base side is insufficient. If retouching dyes are to be applied to the emulsion side, the dye concentrate should be diluted with water containing one drop of KODAK PHOTO-FLO 200 Solution per 30 mL (1 fluidounce) of water instead of KODAK E-6 Retouching Dye Buffer. To avoid fading of the image dyes, do not use the buffer solution on the emulsion side of E-6 transparencies. Do not premoisten the emulsion area to be retouched.

Use the weak, water-diluted PHOTO-FLO 200 Solution mentioned above to remove any excess dye concentrate remaining on the emulsion or base surface. To minimize water spotting, retouched areas can be wiped with anhydrous denatured alcohol.

KODAK E-6 Transparency Retouching Dyes should always be stored in stoppered glass bottles in order to prevent evaporation. Evaporation adversely affects the penetration rate and duplication quality of the dyes.

The dyes can be used at full strength as supplied, or if weaker solutions are required, they can be diluted with water or dilute buffer. If large quantities of dilute dye are required for tray dyeing, equal volumes of dye concentrate and dilute buffer can be combined and then further diluted with water.

The three dyes—cyan, magenta, and yellow—can be mixed in the palette in any proportion to produce the proper retouching color. Four colors can be mixed by combining the dyes in the following proportions, and can be stored for the indicated times.

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		Storage Time
BLACK	—Equal volumes of cyan, magenta, and yellow dyes.*	12 hours
GREEN	—Equal volumes of dilute E-6 buffer, cyan dye, and yellow dye	12 hours
RED	—Equal volumes of magenta and yellow dyes	1 week
BLUE	—Equal volumes of magenta and cyan dyes	1 week

These dye mixtures are unstable and, if they are stored longer than the indicated times, the colors will change and will not reproduce accurately.

The penetration rate of E-6 Transparency Retouching Dyes is increased when the dyes are mixed with dilute acetic acid. Use 1 drop of 7 percent acetic acid mixed with 10 drops of *undiluted* dye. This solution is useful when maximum dye penetration is needed and a semidry brush technique, for fine detail, is being used. Greater acidification should be avoided because of the adverse effect of acid on dye uniformity and reproduction color quality.

To make 1 litre of 7 percent acetic acid solution, add 70 mL of glacial acetic acid to 930 mL of water, or add 250 mL of 28 percent acetic acid to 750 mL of water.

CAUTION: Add the acid to the water, never the water to the acid.

Partially dried dyes in the palette can be redissolved with dilute buffer solution. Completely dried dyes should be discarded.

RETOUCHING SMALL DEFECTS

Usually, light areas of an original transparency can be filled in readily with pencil or dye, but dark areas must be blended with the surroundings to make them less obvious, or they can be bleached and then retouched.

Eliminating small dark areas by partially removing density in all three dye layers with an etching knife is not advisable. When it is attempted, the successive layers are removed, one at a time, depending upon the depth of the etch. In a neutral area, for example, the removal of the top layer will leave a blue spot; further etching, a cyan spot.

Generally, the aim of retouching small dark areas should be to blend them by adding color to the surroundings, thus making them less apparent.

Use of Pencils — *Pencil retouching should be confined to transparencies that will be used only for viewing purposes, not for reproduction.* There are several types of colored pencils on the market that are suitable for retouching, such as Eagle Prismacolor or Eberhard Faber Colorama pencils. Pencil retouching, which should be done after any bleaching or dyeing, can be applied to either the base or the emulsion side of the transparency if a "tooth" on the surface has been provided.† Use lintless tissue or absorbent cotton to spread several drops of KODAK Retouching Fluid with a circular motion over the portion of the transparency to be corrected. A somewhat thicker application is necessary than in the case of ordinary black-and-white retouching. Allow the retouching fluid to dry for a few minutes before applying the color. Sharpen the pencils to a long tapering point with fine sandpaper or emery cloth. Select the proper color, and bring the area to the required density and color with a series of pencil strokes. If sufficient color cannot be applied, turn the transparency over and repeat the above operations. When pencils are applied to the emulsion side, take care not to damage the emulsion. Where a great amount of color must be added, use dyes.

Small light areas and pinholes can be corrected with an extremely soft black lead in the same manner. If it is necessary to remove the retouching completely, wipe the area with anhydrous denatured alcohol.

AREA CORRECTION

Areas of a transparency may require the addition of color in order to improve the overall effect. For example, a background color may be too light to contrast sufficiently with the principal subject. A darker color can be produced by using dyes, colored overlays, or masks. Hue changes can also be made, but areas can be lightened only by bleaching techniques. (See pages 6 through 8.)

Color, in the form of dyes, can be added to the *base side* of color transparencies to alter or enhance the color of skin, hair, clothing, background, etc.

The following techniques may be used on transparencies that will not be duplicated or reproduced by photomechanical means.

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*A mixture of equal quantities of the three dyes will provide a reasonable neutral when applied to the *base* side of a transparency. If dyes must be applied to the emulsion side, an adjustment in the mixture of dyes may be necessary to make a good neutral. Slight acidification of the neutral dye mixture (1 drop of 7 percent acetic acid in 10 drops of undiluted dye) will help to maintain a neutral and provide improved dye penetration for emulsion-side application.

†The majority of Kodak color transparency films have a gelatin pelloid on the base that accepts pencil and dye retouching readily. However, the following products are exceptions: KODACHROME Films, Process E-6 films in 35 mm sizes, and other 35 mm and 70 mm color-reversal films in long rolls or spooled without backing paper. These films should be treated with KODAK Retouching Fluid if pencil work is to be done on the base. Dye retouching can be done only on the emulsion side.

Dry-Dye Technique — The simplest and most effective method of adding color involves the use of KODAK Retouching Colors. These colors, supplied as jars of dry-dye cakes, are applied to the transparency in dry form with the aid of cotton tufts. One of the big advantages of this dry-dye technique is that you can experiment freely until you get the desired effect in color and density. Mistakes are easily remedied. After you have achieved the desired corrections, you make them permanent with a simple application of steam.

The surface of the transparency to be treated should be clean and thoroughly dry, because moisture will tend to set the dyes prematurely. (Preferably, the humidity should be low in the retouching area.) Before adding any dye, buff the surface lightly with a tuft of dry, clean cotton. Avoid scratching the surface, since the scratches will fill with dye and become accentuated.

To begin, breathe on the dry cake of KODAK Retouching Color to be used. Then, pick up a generous amount of dye on a tuft of dry cotton and spread the dye evenly over the area to be corrected. Two or more colors can be applied directly on the surface that is being treated. Any slight overlap can be removed later. To smooth out or lighten the color, rub the area lightly with a clean tuft of dry cotton. (The dye at this stage is at the top surface of the transparency. Keep your fingers away from the working area because moisture and heat from your fingers will set the dyes, making dye removal difficult.)

If you make a mistake and want to start over, or if you want to remove overlapped color, use the jar of reducer. Breathe on the cake of reducer and pick up a medium amount of the reducer on a tuft of dry, clean cotton. Rub the reducer over the area to be treated. Remove any excess reducer with tufts of clean, dry cotton. If overlapped dye is to be removed from a straightedge image, use a sheet of paper to cover the wanted portion while the unwanted dye is removed. Sharp edges can be softened by light buffing with clean, dry cotton tufts. Anhydrous denatured alcohol can be used as a substitute for the reducer if desired.

When you have achieved the desired retouching effect, you will want to set the dyes into the gelatin. This is done by applying steam to the retouched transparency. A convenient source of steam is an inexpensive bottle-warmer, vaporizer, or steam vaporizer-humidifier. Holding the transparency 8 to 10 inches above the source, subject the retouched area to gentle steam for about 20 seconds. Repeat if necessary. Wait about 1 minute for the transparency to dry, then buff the area lightly with dry cotton. If you find you can't get enough dye into the transparency in one application, repeat the process after steaming and drying.

Dye in the transparency that has been set by steam can be removed by washing the transparency in running water at 24°C (75°F) for 8 to 10 minutes.

Wet Technique — Another dye-retouching method involves washing water-soluble dyes onto the transparency with a brush. The application is usually made to the base side. Unwanted dye can be removed from the base side as described below.

KODAK E-6 Transparency Retouching Dyes and KODAK Retouching Colors can be diluted with water and applied with a brush. The strength of the dye should be such that when a brushful is spread on a piece of clear film or glass, the dye density will be somewhat less than that needed for the selected area of the transparency. This procedure allows the density to be built up gradually and evenly in several applications. The color is worked into the desired area. Excess dye is picked up and removed with water-moistened cotton.

Because of their opalescent appearance when wet, transparencies on KODAK EKTACHROME Films for Process E-6 must be dried before the degree of dyeing can be accurately determined.

Removing Dye Retouching — Retouching dye that has been applied to either the base or emulsion side of a transparency can be removed by washing the transparency in running water at 24 ±1°C (75 ±2°F). The time will vary according to the amount of dye that has been added. Follow the wash with a 1-minute rinse in diluted PHOTO-FLO 200 Solution. Dry the transparency at a temperature that does not exceed 43°C (110°F).

To remove a slight amount of retouching dye from the *base* side of a transparency, swab the area with cotton moistened with water. For moderate removal, swab the area on the *base* side of the transparency with a 14 percent solution of ammonium hydroxide followed with clear water. For complete removal of retouching dye, carefully apply a permanganate bleach (such as KODAK Total Dye Bleach SR-30) to the *base* side of the transparency. The formula for KODAK Total Dye Bleach SR-30 is given on page 6. Following the bleach application, wipe the area with a 5 percent sodium bisulfite solution to remove the brown stain left by the permanganate. Remove the permanganate stain *completely* before adding new dyes, or the transparency may not duplicate properly. Finally, rinse the area with water, wipe with a 1/10 percent solution of acetic acid, and blot.

NOTE: If dyes have been applied to the emulsion side of the transparency, they can be removed *only* by washing the entire transparency in water.

Use of Overlays — Rather than being applied directly to an original transparency, with consequent risk of damage, retouching can be applied to an overlay, such as a sheet of fixed-out KODAK Commercial Film (treated with KODAK Retouching Fluid if the work is to be done with pencils), which has been taped to the back of the original. If large areas are being retouched, it is preferable to use dyes rather than colored pencils.

Another method for local correction involves the use of transparent, colored overlays. Such materials are available in different hues and concentrations from art-supply stores. The sheet that gives the desired effect in the area to be changed is selected and attached on the reverse side of the transparency with masking tape. The color can then be removed from other areas of the overlay sheet by use of a stylus and color-remover solution. Sheets in various densities of gray are also available to darken an area of the transparency.

PHOTOGRAPHIC COLOR-BALANCE CORRECTION

The final method for retouching a color transparency involves making a contact color-separation negative from the transparency. From a negative, a contact positive gelatin relief film (usually termed a "matrix") is made, dyed, and transferred to the base side of the transparency. It provides overall correction for an off-balance original without the limitations inherent in the use of a color filter over the transparency or the application of a small amount of dye to the transparency. Frequently, a transparency that may have been made at considerable expense, but is unusable because of poor color balance, can be salvaged by this procedure. To carry out this type of correction, the equipment and materials normally used in the making of color prints by the Kodak Dye Transfer Process are needed. Refer to *Kodak Dye Transfer Process*, Kodak Publication No. E-80, a single copy of which is available on request from Department 412-L, Eastman Kodak Company, Rochester, New York 14650.

PROCESS E-6 BLEACHES

Bleaching Spots — Objectionable dark dye spots on Process E-6 EKTACHROME Transparencies can be bleached with KODAK Total Dye Bleach SR-30 as follows:

1. Mix Solutions A and B as directed and apply the bleach with a brush to the dark spot for 30 seconds or less. Extended treatment will produce very little additional bleaching and may cause excessive stain and damage to the emulsion.

2. Immediately following the total bleach treatment, apply a 5 percent sodium bisulfite solution for approximately 1 minute, or until no color change occurs. (To make a 5 percent sodium bisulfite solution, add 50 grams of sodium bisulfite to 950 mL of water.) It is not necessary to remove excess total bleach solution before applying the 5 percent sodium bisulfite solution.

3. Rinse the area with two or three applications of water to remove the sodium bisulfite solution.

4. Repeat Steps 1 through 3 until the desired change in density is attained. Then extend the final rinse step (No. 3) to four or five applications.

Solutions A and B can also be used as separate solutions. Some retouchers prefer the following procedure to obtain faster bleaching and softer edges:

1. Apply Solution A in quick, multiple applications, swabbing with water-moistened cotton between applications.

2. Apply Solution B in quick, multiple applications, swabbing with water-moistened cotton between applications.

3. Clear the area with a 5 percent sodium bisulfite solution. Repeat Steps 1 through 3 if more bleaching is required.

TOTAL BLEACH

KODAK Total Dye Bleach SR-30

NOTE: SR-30 stock solutions are stable and can be prepared in advance. Do not use or store in metal containers.

Stock Solution A

Water, 60 to 80°C (140 to 176°F)	350 mL
Potassium permanganate	50 grams
Cold water	600 mL

Dissolve the permanganate crystals completely in the hot water before adding the cold water.

Stock Solution B

Water	900 mL
Sulfuric acid (concentrated)	50 mL
Sodium sulfate	115 grams

WARNING! Always add concentrated sulfuric acid to water slowly, stirring constantly, and never the water to the acid; otherwise the solution may boil and spatter the acid on the hands or face, causing serious burns.

Add the sodium sulfate to the solution while stirring constantly to prevent caking.

Combine equal quantities of Stock Solution A and Stock Solution B. Discard when the combined solution turns brown.

WARNING! Dangerous chemical solutions; avoid contact with skin or eyes. Maintain all solutions and washes at 18 to 27°C (65 to 80°F). Do not use in metal containers.

Follow the bleach with a 5 percent sodium bisulfite solution and then a wash to prevent staining.

SELECTIVE BLEACHES

KODAK Cyan Dye Bleach SR-31

NOTE: Mix SR-31 Bleach fresh and discard it after 48 hours.

	Tray Use	**Brush Use**
Water	1 litre	200 mL
Sodium acetate, dessiccated or anhydrous	22 grams	22 grams
Sodium Dithionite (Pract.) (CAT No. P533)*	1.5 grams	1.5 grams

WARNING! Flammable solid. May ignite if allowed to become damp. Keep containers tightly closed. Store in a cool, dry place.

KODAK Magenta Dye Bleach SR-32

NOTE: Mix SR-32 Bleach fresh and discard it after 48 hours.

	Tray Use	**Brush Use**
Water	1 litre	200 mL
Ethylenedinitrilo tetraacetic Acid Disodium Salt (CAT No. 6354)*	1 gram	1 gram
Stannous Chloride (Pract.) (CAT No. P435)*	10 grams	10 grams

Dissolve the chemicals in the order given.

NOTE: Old or impure stannous chloride may not dissolve readily. If necessary, grind it to a fine powder. Discard any undissolved residue.

A white precipitate which forms in this solution is extremely difficult to remove from the film once it has dried. Therefore, wipe the film with a clean viscose sponge while it is immersed in the wash.

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*EASTMAN Organic Chemicals can be obtained only from laboratory supply dealers. When ordering chemicals by mail, include the statement "These chemicals will not be used for drug purposes or sold by us for such use" to avoid delay in shipment.

KODAK Yellow Dye Bleach SR-33

NOTE: Mix SR-33 Bleach fresh for each use and discard any unused portion.

	Tray Use	Brush Use
Water	900 mL	200 mL
Sodium chloride	approximately 180 grams	0
KODAK Total Dye Bleach SR-30 Stock Solution A	5 mL	5 mL
KODAK Total Dye Bleach SR-30, Stock Solution B	10 mL	10 mL

The sodium chloride can be measured as one full measuring cup, or one full 250 mL beaker. Common table salt can be used.

WARNING! Do not use sodium chloride or table salt with a higher concentration of KODAK Total Dye Bleach SR-30 Stock Solution A (potassium permanganate) than specified, because *toxic chlorine gas will be released, which is hazardous if inhaled.*

Caution: Do not use or store KODAK Yellow Dye Bleach SR-33 in metal containers.

Follow the bleach with a 5 percent sodium bisulfite solution and then a wash to prevent staining.

KODAK Yellow Dye Bleach SR-34

NOTE: Mix SR-34 Bleach fresh for each use and discard any unused portion.

	Tray Use	Brush Use
Water	1 litre	200 mL
Chloramine-T (CAT No. 1022)*	10 grams	10 grams
7 percent acetic acid solution	Add by the drop, with stirring, until a definite cloudiness persists.	

To make 1 litre of 7 percent acetic acid solution, add 70 mL of glacial acetic acid to 930 mL of water or add 250 mL of 28 percent acetic acid to 750 mL of water.

WARNING! Chloramine-T is an extremely irritating compound when dust is inhaled or allowed to contact the skin. When it is dissolved in water, chlorine gas is released, which is also hazardous if inhaled. All skin and eye contact, or inhalation of gas, must be prevented.

Caution: Add the acid to the water, never the water to the acid.

Caution: Do not use or store KODAK Yellow Dye Bleach SR-34 in metal containers.

KODAK Red Dye Bleach SR-35
(removes both magenta and yellow dye)

NOTE: This solution can be prepared in advance.

	Tray Use	Brush Use
Water	900 mL	Not Recommended
Sulfuric acid (concentrated)	150 mL	

WARNING! Always add concentrated sulfuric acid to water slowly, stirring constantly, and never the water to the acid; otherwise, the solution may boil and spatter the acid on the hands or face, causing serious burns. Do *not* prepare a stronger concentration than the formula above.

Use rubber gloves for preparation and tray use.

Do not use KODAK Red Dye Bleach SR-35 for brush use because of danger to health and property.

Applications of KODAK Red Dye Bleach SR-35, followed by KODAK Cyan Dye Bleach SR-31, will have an overall bleaching action.

KODAK Dye Regenerating Solution RG-1

NOTE: This solution can be prepared in advance.

	Tray Use	Brush Use
Water	1 litre	200 mL
Potassium ferricyanide	5 grams	5 grams

Use for up to 5 minutes to regenerate either cyan or magenta dye that has been overbleached. However, this regeneration method does not apply to magenta dye that has been bleached with KODAK Red Dye Bleach SR-35.

Bleaching Large Areas — KODAK Total Dye Bleach SR-30 can be used to remove the dye from relatively large areas of Process E-6 EKTACHROME Transparencies, as follows:

1. Apply a waterproof frisket material of your choice (such as Photo Maskoid [red or clear], manufactured by Andrew Jeri Company, Inc., 190 Horseneck Road, Caldwell Township, New Jersey 07007; or Transpaseal, available from A. I. Friedman Company, 25 West 45th Street, New York, New York 10036) to the areas of the *emulsion side* of the transparency that are to be retained. Be sure that all such areas are thoroughly protected.

2. Immerse the transparency in a tray of KODAK Total Dye Bleach SR-30 solution for 30 seconds with constant agitation. Drain for 5 to 10 seconds. (Do not wash with water at this step; eventual emulsion damage may result.)

3. Immerse the transparency in the 5 percent sodium bisulfite solution, with agitation, for approximately 1 minute or until no color change occurs.

4. Wash the transparency in running water for 30 to 60 seconds.

5. Repeat Steps 2 through 4 until the desired change in density is attained. Then extend the final wash to 5 minutes. A residual image, visible when the transparency is wet, may become invisible when the transparency is dried.

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*EASTMAN Organic Chemicals can be obtained only from laboratory supply dealers. When ordering chemicals by mail, include the statement "These chemicals will not be used for drug purposes or sold by us for such use" to avoid delay in shipment.

The following general instructions apply to all the KODAK Selective Dye Bleaches for KODAK EKTACHROME Films for Process E-6:

To promote uniform bleaching action, prewet the area for approximately 1 minute with water containing a few drops of KODAK PHOTO-FLO 200 Solution. The quantity of PHOTO-FLO 200 Solution depends upon the quality of the water, the film cleanliness, and individual preference. Uniform bleaching action also requires constant agitation of the bleaching solutions in various directions on the working area of the transparency.

All of the bleaches are more easily controlled and are more selective in their bleaching action when they are used at 24°C (75°F). For instance, KODAK Magenta Dye Bleach SR-32, when used at 24°C (75°F), removes only magenta dye. At 38°C (100°F), an equivalent amount of magenta dye is bleached in a shorter time, but a significant amount of cyan dye is also removed. The choice of bleaching solution temperature will affect the time required for bleaching, the ease of bleaching control, and the selectivity of the dyes bleached.

All of the selective dye bleaches, with the exception of KODAK Red Dye Bleach SR-35, are unstable, particularly when they are exposed to air at high temperatures. Also, they are exhausted after treating a few transparencies. For the most predictable results, use freshly prepared bleaching solutions at a consistent temperature, preferably 24°C (75°F).

In the first minute of bleaching (at low temperature) a "just noticeable" amount of dye is removed. However, the rate of bleaching increases with longer immersion times.

When multiple bleaches are used, always bleach yellow or red before bleaching cyan and magenta. If the reverse order is used, the cyan and magenta dyes will be regenerated. (This does not apply to the magenta dye bleached by KODAK Red Dye Bleach SR-35.)

After bleaching, wash the transparency thoroughly in running water at 24°C (75°F) for at least 10 minutes. Thorough washing is important to prevent regeneration of bleached cyan and magenta dyes during dry storage. (For water and energy conservation, three separate fresh water baths can be substituted for running water.) Following the final wash, rinse the transparency in KODAK Stabilizer, Process E-6, for 1 minute and dry at a temperature of 43°C (110°F) or lower.

Because of their opalescent appearance when wet, transparencies on KODAK EKTACHROME Films for Process E-6 must be dried before the degree of bleaching can be determined accurately.

VIEWING TRANSPARENCIES

In 1970, the American National Standards Institute adopted a new standard for the *critical* viewing of photographic color transparencies on a diffuse illuminator. Copies of PH2.31-1969, *Direct Viewing of Photographic Color Transparencies*, can be purchased from the American National Standards Institute, Inc., 1430 Broadway, New York, New York 10018. This standard has been accepted by the photographic and graphic arts industries. It does not apply to the viewing of reflection photographic color prints or to the viewing of projected transparencies.

Briefly, the standard specifies the following:

1. The chromaticity of the illuminator surface shall be approximately that of a CIE Daylight Illuminant at a correlated color temperature of 5000 K.

2. The relative spectral power characteristics of the illuminator shall, ideally, be the same as those of CIE Illuminant D_{5000}.

3. The CIE General Color Rendering Index (CRI) of the illuminator surface shall have a value of 90 or higher.

4. The average luminance of the viewing surface shall be 1400 ±300 candelas per square metre (409±88 footlamberts).

5. The diffusion characteristics shall be as described.

Fluorescent tubes that meet the standards of 5000 K and a CRI of 90 or higher are manufactured by several companies. Macbeth Prooflite, Duro-Test Optima 50, and General Electric Chroma 50 fluorescent tubes are currently available. Ready-made transparency illuminators that meet the new standard are available from Macbeth Corporation, Newburgh, New York 12550.

Although ideal, it is not imperative that advertising or decorative display illuminators conform exactly to the ANSI Standard mentioned above. Light sources that range in color temperature from 3800 to 5000 K are satisfactory *if* they emit adequate amounts of light in the blue, green, and red portions of the spectrum that are related to the absorptions of the dyes used in color films. The Color Rendering Index (CRI) is a scale from 0 to 100 used to describe the visual effect of light sources on eight standard pastel colors. These eight colors are viewed under light from the source to be rated, and under light from a blackbody source *of the same color temperature*. The average difference in the appearance of the colors is used to determine the CRI. The closer the comparison between the two sources, the higher the CRI for the source to be rated. Since the rated light source is compared only to a blackbody matching it, the CRI ratings of two sources with different color temperatures cannot be compared.

Deluxe, cool white fluorescent tubes having a color temperature of about 4200 K and a Color Rendering Index of about 89 are satisfactory for use in display illuminators. Cool white fluorescent tubes are not satisfactory, even though they are rated at a color temperature of 4200 K. They have a low Color Rendering Index, approximately 66, and emit an inadequate amount of light in the red portion of the spectrum. The red areas in a transparency will appear grayed when viewed by cool white fluorescent tubes.

EVALUATING TRANSPARENCY RETOUCHING

Using Separation Filters — A valuable aid in evaluating the effect of retouching on color transparencies is a set of three separation filters consisting of KODAK WRATTEN Gelatin Filters No. 25 (red), No. 58 (green), and No. 47B (blue). Since the retouching dyes, as well as the dyes in the film, are subtractive primary colors, it is possible to view a retouched transparency through additive primary color filters, such as those used to make color-separation negatives for photomechanical reproduction. You can visually inspect each film layer and the retouching affecting it individually.

For instance: Viewing a transparency through a WRATTEN Gelatin Filter No. 25 (red) permits you to see only the cyan dye layer and those components of the retouching dyes that are cyan. The transparency appears to be red, with shades of density where the cyan dye is located. A WRATTEN Gelatin Filter No. 58 (green) reveals only the magenta dye layer and retouching, and a WRATTEN Gelatin Filter No. 47B (blue) shows the yellow layer and retouching. Of course, the light source used to illuminate the transparency must be of the proper CRI (see "Viewing Transparencies" page 8). Faulty retouching will appear as lighter or darker tones against the surrounding area.

Complementary Colors

WRATTEN		KODAK EKTACHROME Film Retouching Dye
Filter No.	**Filter Color**	**Color**
25	RED	Cyan
58	GREEN	Magenta
47B	BLUE	Yellow

Procedure —

1. Select an area on the transparency of the proper color and density to serve as a guide for comparison.

2. Determine what color dye to add first by viewing the transparency successively through the three separation filters.

3. Start retouching by adding dye complementary to the filter that showed the greatest degree of density variation in the area to be retouched when compared to the reference area. Add the dye to the transparency, while continually viewing through the filter, until the density variation falls just short of matching the area of proper color and density.

4. Viewing through the filter that showed the second-greatest degree of density variation when the transparency was first evaluated, add complementary dye to the area to be retouched. Again, bring the density to a point just short of matching.

5. Using the remaining color-separation filter and its complementary dye, bring the final layer to just short of equal density.

6. Repeat Steps 3 through 5 as often as necessary, each time bringing the dye densities closer to the desired tone, until no density difference exists when the transparency is viewed through each of the filters.

7. If the retouched area shows a density heavier than the reference area when viewed through any one of the three filters, there is too much of the dye complementary to that filter. Remove some of the dye (see page 4).

Using Color Compensating Filters — Another method to avoid guesswork in transparency retouching is to use KODAK Color Compensating (CC) Filters.

For example: To correct a transparency with an off-color area:

Viewing through CC filters of various colors and densities, determine which color corrects the offending area. These filters change the overall color balance slightly and indicate the color of dye you should add to the area. They can be used singly, or in combination, for almost any desired correction. The density of each filter is indicated by the two numbers, and the color by the final letter, printed in one corner of the filter. A variety of filters in density and color should be available. As a starting selection, a 0.05, 0.10, and 0.20 density of each color is recommended.

The complete listing of KODAK Color Compensating Filters is given below.

When retouching in this, or any other manner, build up the dye densities slowly!

Red	**Green**	**Magenta**
CC025R	CC025G	CC025M
CC05R	CC05G	CC05M
CC10R	CC10G	CC10M
CC20R	CC20G	CC20M
CC30R	CC30G	CC30M
CC40R	CC40G	CC40M
CC50R	CC50G	CC50M
Cyan	**Blue**	**Yellow**
CC025C-2	CC025B	CC025Y
CC05C-2	CC05B	CC05Y
CC10C-2	CC10B	CC10Y
CC20C-2	CC20B	CC20Y
CC30C-2	CC30B	CC30Y
CC40C-2	CC40B	CC40Y
CC50C-2	CC50B	CC50Y

NOTICE

The procedures which have been described in this pamphlet are those which have been found by trial by Eastman Kodak Company to give satisfactory results. It is believed that as production experience is gained by the professional users of color materials, new techniques will be developed in retouching and methods of control. The information contained herein is intended, therefore, to serve as a preliminary guide in the use of these materials and as an aid in solving some of the problems encountered in the production of retouched transparencies.

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While Kodak products were used to provide these recommendations, equivalent products can be used if desired.

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